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WEATHER AND CIRCULATION OF DECEMBER 1971

Return to a Persistent Temperature Regime

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1. MEAN CIRCULATION

One of the major circulation developments during December 1971 was the striking amplification of the east Pacific ridge which accompanied modest deepening of both the low-latitude central Pacific trough and the Asiatic coastal trough (figs. 1–3). Below-normal mean heights in the south-central Pacific coupled with above-normal heights southeast of Japan have persisted since October (Dickson 1972, Taubensee 1972).

Downstream from the east Pacific ridge, amplification spread through the complex of troughs over and near western North America, to the East Coast ridge and thence to the western Atlantic trough. The latter feature extended northward to an intense upper Low over Baffin Bay. This Low, together with an upper ridge north of

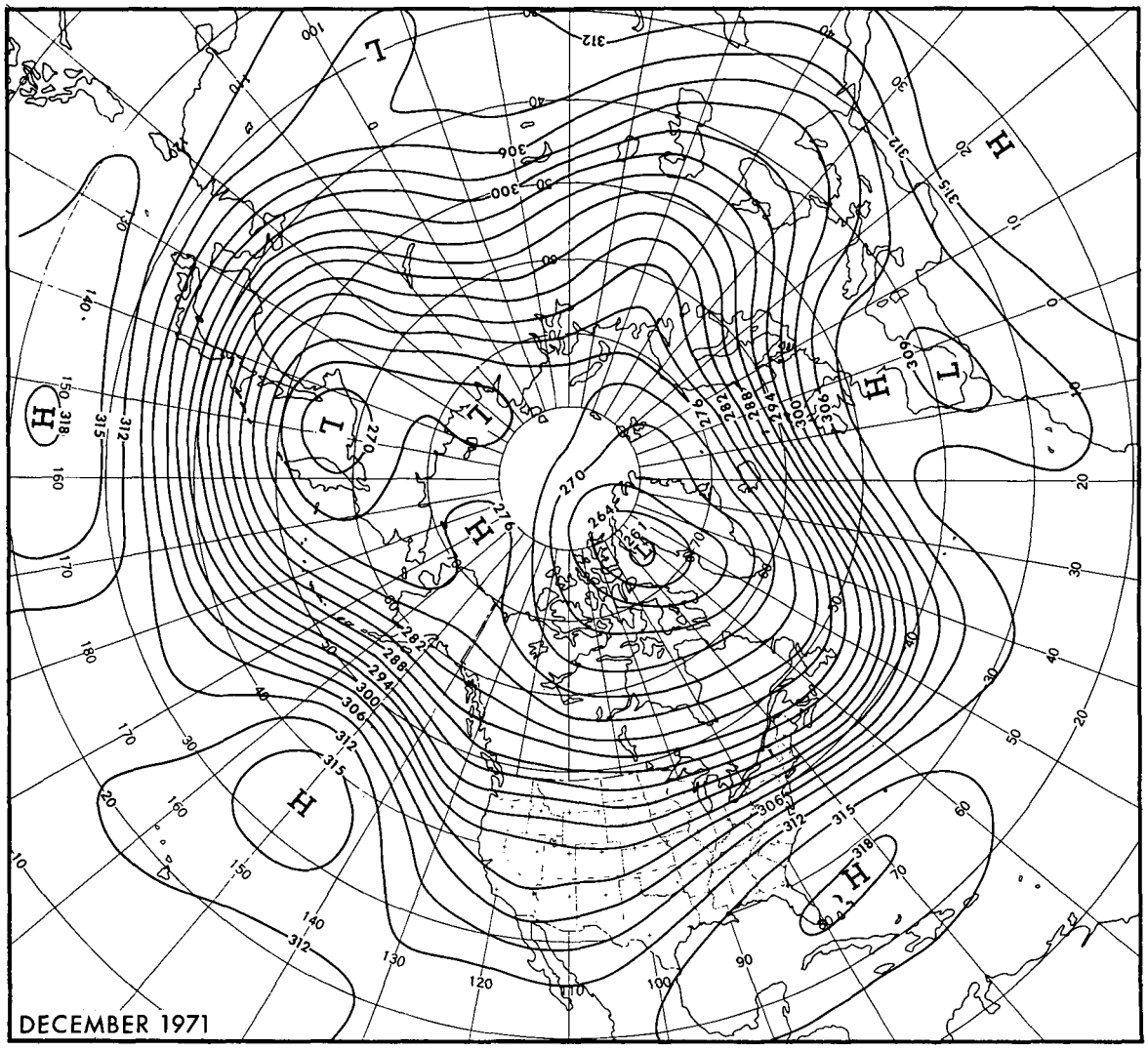


FIGURE 1.—Mean 700-mb contours in dekameters (dam) for December 1971.

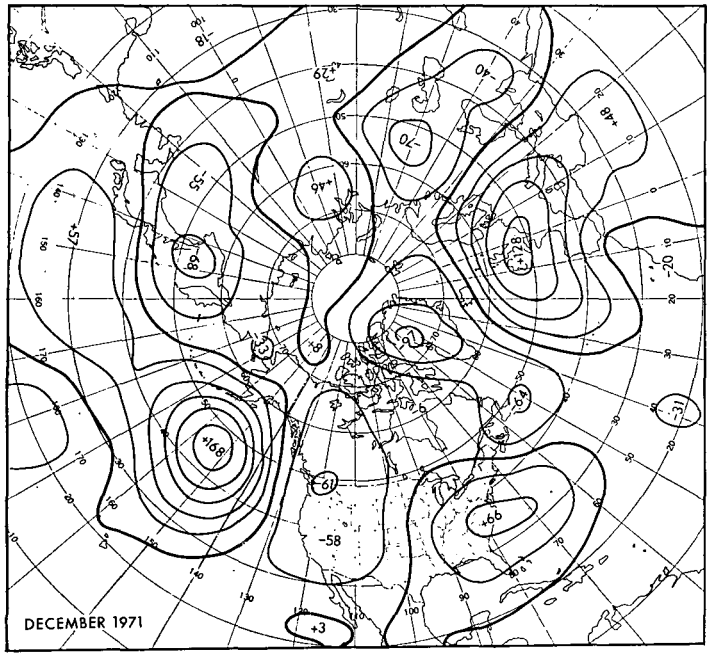


FIGURE 2.—Departure from normal of mean 700-mb height (m) for December 1971.

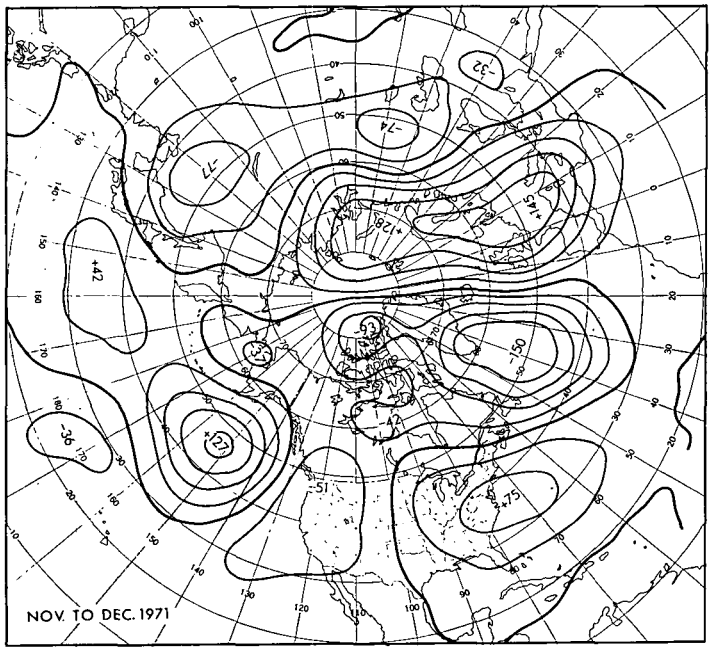


FIGURE 3.—Mean 700-mb height anomaly change (m) from November to December 1971.

Alaska, drove quite cold air across eastern Canada, contributing to the intensification of storm systems as well as to the middle- and high-latitude westerlies over the Atlantic during December. This westerly wind increase was associated with progression to the North Sea of the previously retrograding Atlantic ridge (Taubensee 1972) and a progression of the European mean trough. Northern portions of this trough filled decisively (fig. 3) as

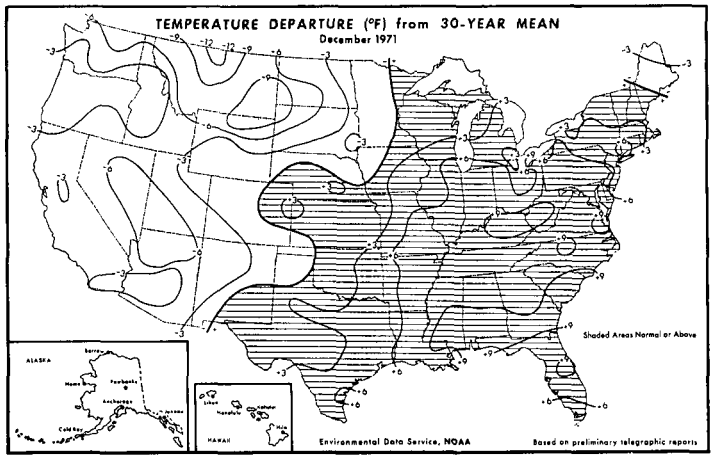


FIGURE 4.—Departure from normal of average surface temperature (°F) for December 1971 (from Environmental Data Service and Statistical Reporting Service 1972).

maritime air was advected over and near Scandinavia. The ridge over central Asia flattened at middle latitudes while building in the north.

2. MONTHLY TEMPERATURE

The amplifying long wave pattern in the vicinity of North America during December brought strong contrasts in mean temperatures to the United States (fig. 4), reinstating a pattern similar to that of September and October (Dickson 1972). The building east Pacific ridge, together with the deepening complex of western troughs, drove cold air well into the west. Widespread snow cover throughout the month over the Northern Great Plains and the Great Basin contributed to the western cold via enhanced albedo and long-wave radiation. In California, Nevada, and Arizona, this was one of the coldest Decembers of record.

Strong southwesterly flow together with above-normal heights accompanied the warm conditions that prevailed over the eastern half of the Nation. From the Gulf Coast to Ohio and southern New England, this was one of the warmest Decembers of record.

3. MONTHLY PRECIPITATION

Monthly precipitation exceeded normal over most of the United States during December 1971 (fig. 5). That in the West was associated with numerous storm systems driven into the western mean trough by the amplified east Pacific ridge. Developing Lows, moving out of the Southwest and intensifying along the zone of strong air mass contrast in mid-Nation accounted for the above normal precipitation from the west gulf coast to the Great Lakes. The anomalous southerly flow in this area at 700 mb is indicative of a bountiful transport of moisture from the Gulf of Mexico region. From Oklahoma to the Great Lakes, this was one of the wettest Decembers of

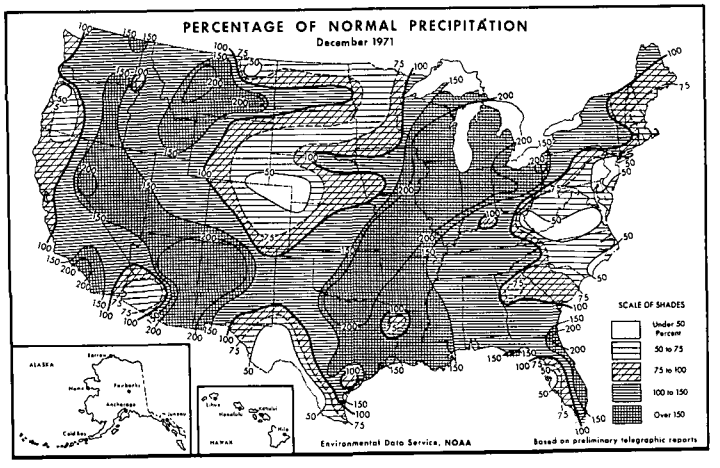


FIGURE 5.—Percentage of normal precipitation for December 1971 (from Environmental Data Service and Statistical Reporting Service 1972).

record. Above-normal precipitation in Montana was generally of an upslope nature, accompanying cold Highs affecting that area. Precipitation in the Southeast occurred during substates not characterized very well by the monthly mean flow pattern. The strong upper ridge along the East Coast contributed to subnormal precipitation in that area, located well to the east of the prevailing storm track.

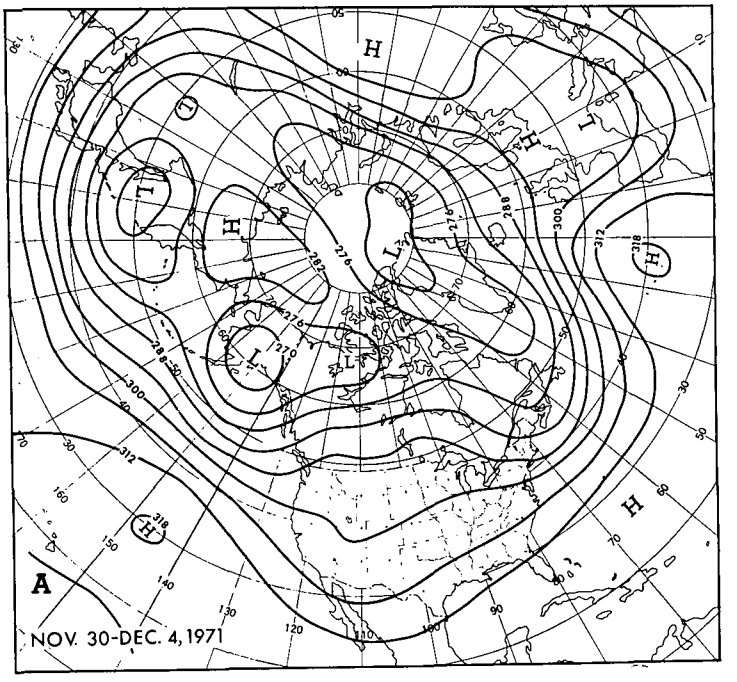
The dry area over Texas was a rain shadow effect of the strong southwesterly flow across the mountains, while that from the Central Great Plains to Minnesota occurred in an area largely by-passed by the prevailing storm tracks.

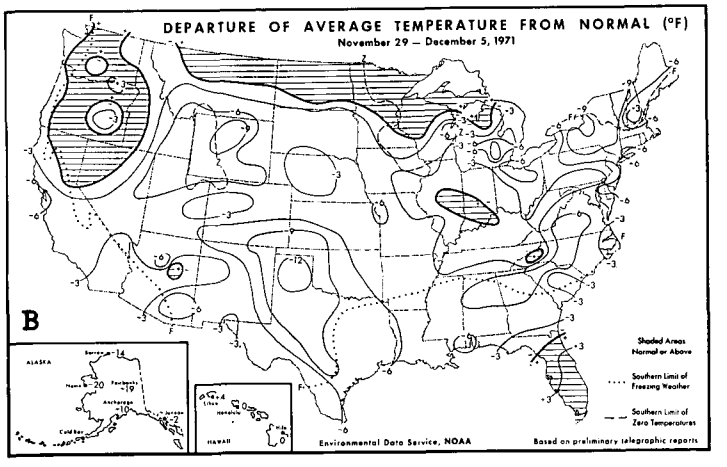
4. VARIABILITY WITHIN THE MONTH

Weekly distributions of temperature and precipitation accompanied by appropriate 5-day mean 700-mb maps are shown in figures 6–10.

Early in the month (fig. 6A), the flow pattern around the hemisphere was generally of moderate amplitude. Over the Pacific and North America, however, a rather flat flow pattern was observed with high- and low-latitude wave trains substantially out of phase. Fast westerlies from south of the Gulf of Alaska Low split into two segments over North America, producing a blocking-type flow pattern.

By the December 7–11 period (fig. 7A), the flow pattern around the hemisphere was amplifying, with building ridges in eastern portions of the Pacific and the Atlantic being especially notable. Amplification in these areas appears to have occurred in surges accompanying upstream deepening at low latitudes (figs. 7A, 9A in the Pacific, figs. 7A, 10A in the Atlantic). Over North America, there was a rapid response to the East Pacific ridging, with both the western trough and the eastern ridge strongly amplifying (fig. 7A). The Pacific amplification culminated in an omega block during the December 21–25





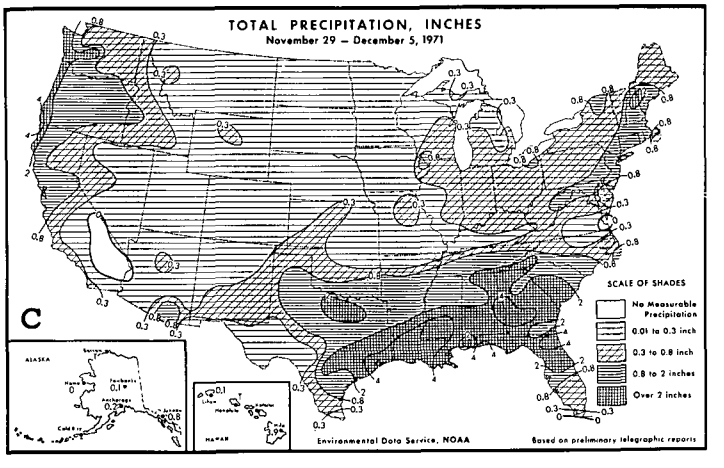
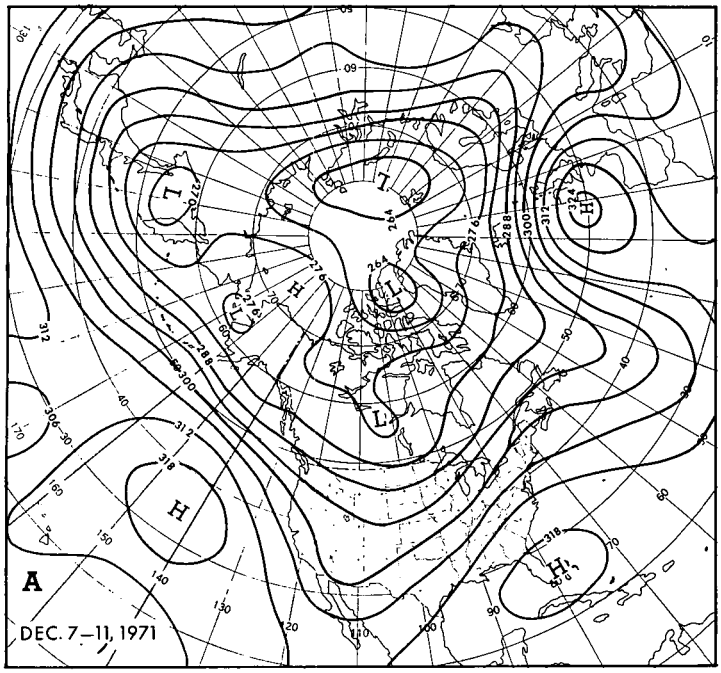
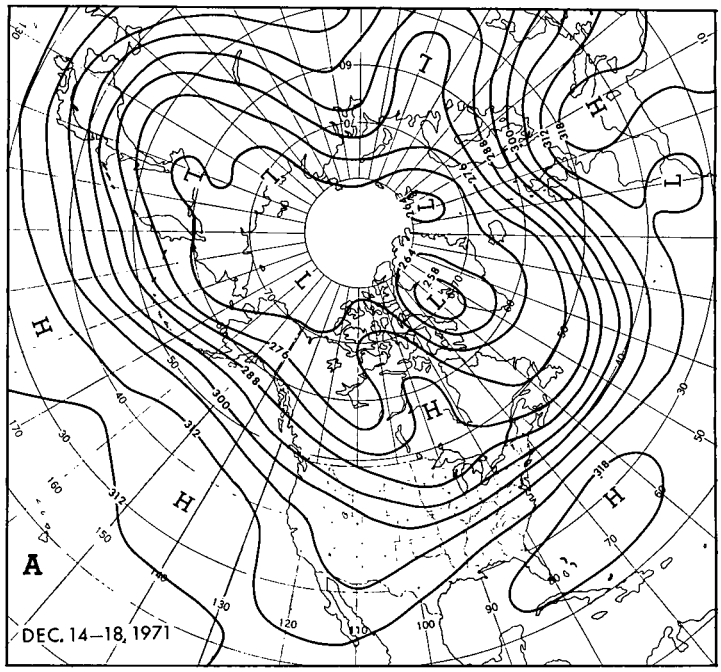
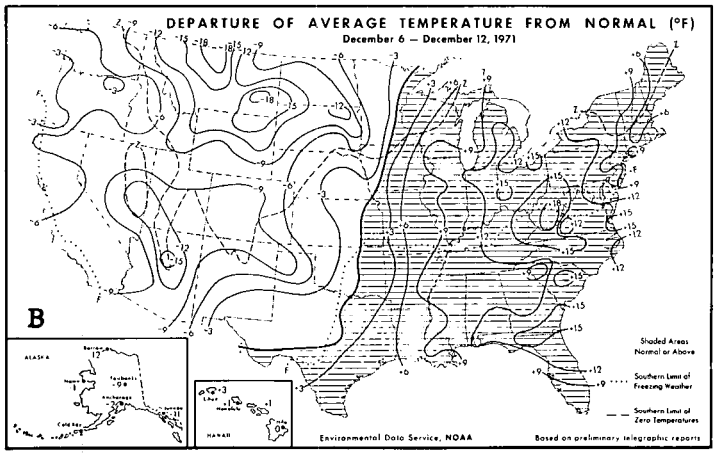
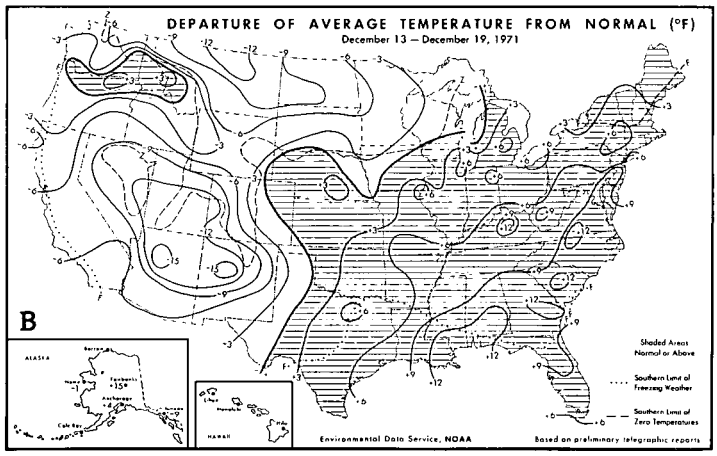


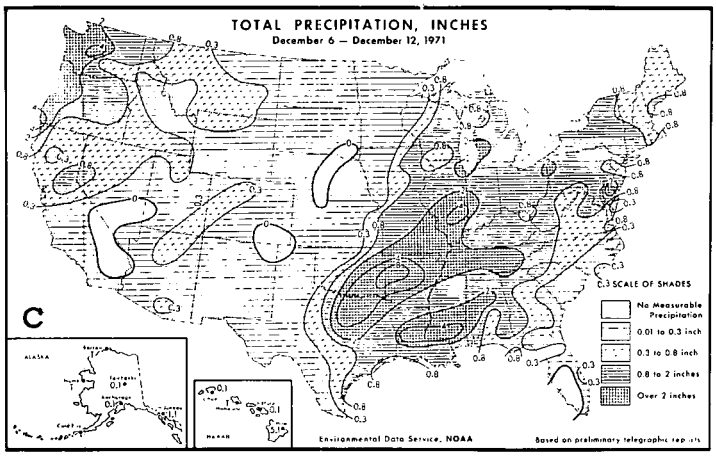
FIGURE 6.—(A) mean 700-mb contours (dam) for Nov. 30–Dec. 4, 1971; (B) departure of average surface temperature from normal (°F) and (C) total precipitation (in.) for week of Nov. 29–Dec. 5, 1971 (from Environmental Data Service and Statistical Reporting Service 1971).











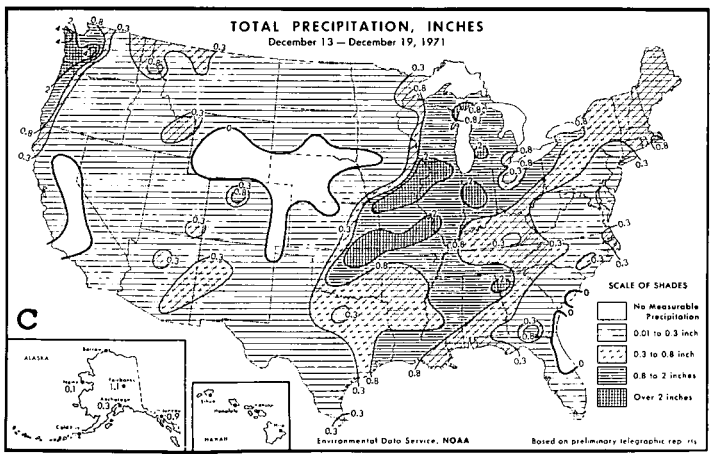
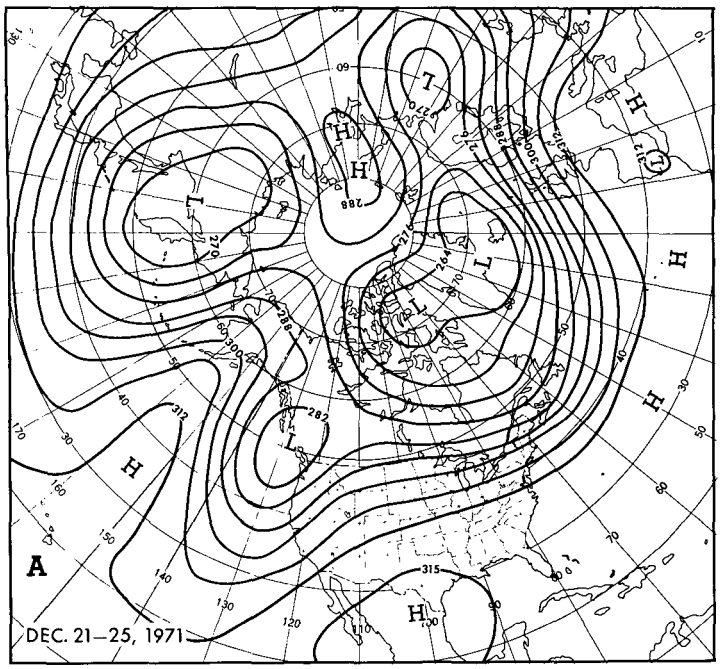


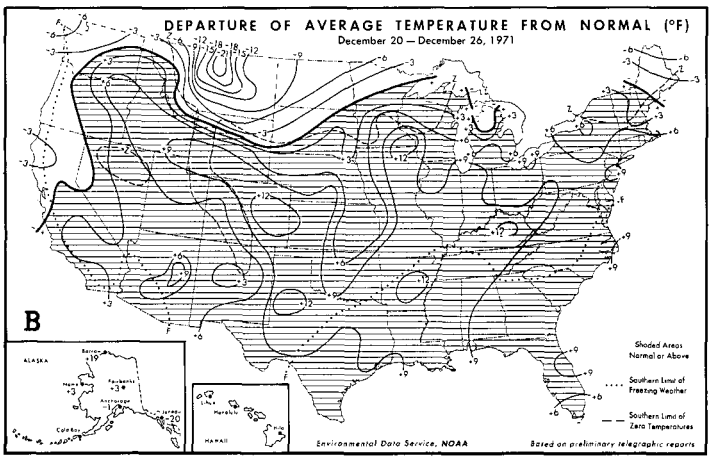
FIGURE 7.—Same as figure 6, (A) for Dec. 7–11, 1971; (B) and (C) for week of Dec. 6–12, 1971.

FIGURE 8.—Same as figure 6, (A) for Dec. 14–18, 1971; (B) and (C) for week of Dec. 13–19, 1971.

period (fig. 9A) which generated a deep Gulf of Alaska Low and retrograded the western mean trough off the West Coast. Amplification was evident over Asia during the December 14–18 period (fig. 8A) after which the midlatitude westerlies reintensified south of a strong high-latitude upper level High (figs. 9A, 10A).

A notable development over eastern Canada was the progressive decline of upper heights during the course of





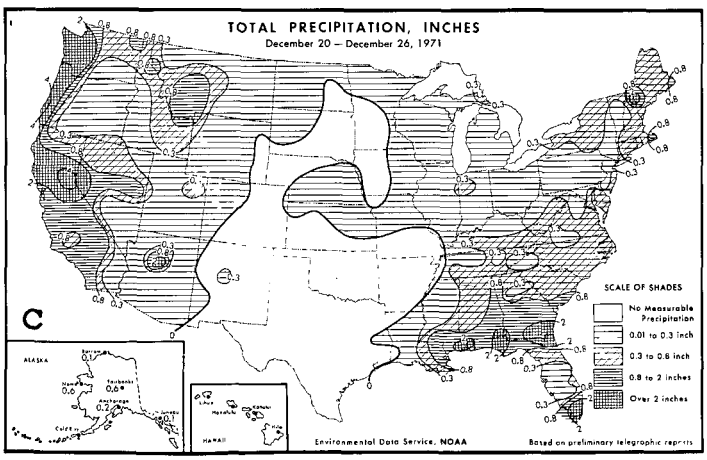
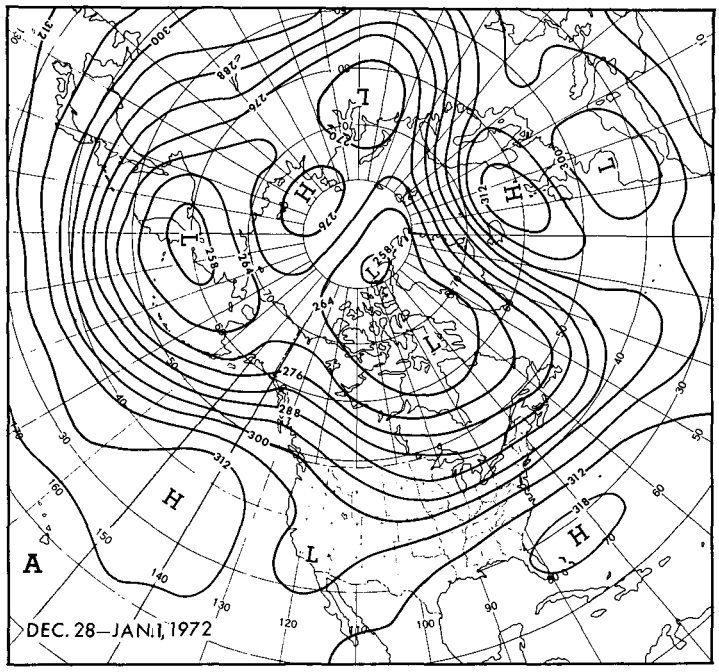
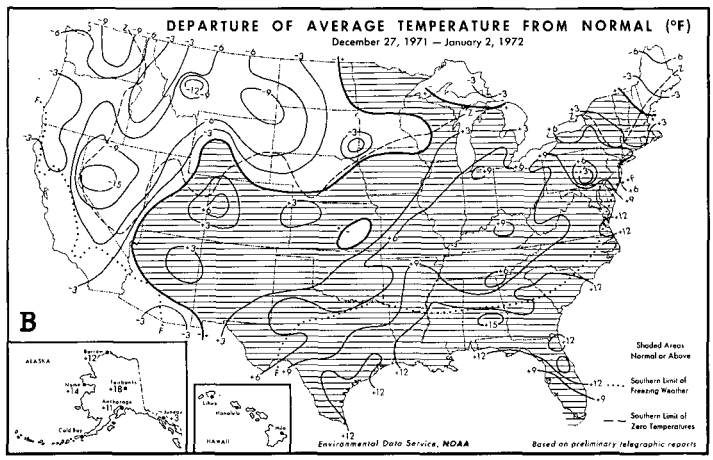


FIGURE 9.—Same as figure 6, (A) for Dec. 21–25, 1971; (B) and (C) for week of Dec. 20–26, 1971.





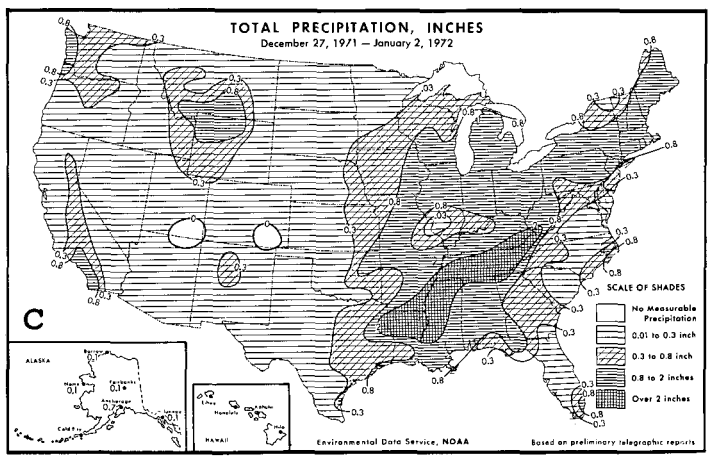


FIGURE 10.—Same as figure 6, (A) for Dec. 28, 1971–Jan. 1, 1972; (B) and (C) for week of Dec. 27, 1971–Jan. 2, 1972.

the month as a deep trough replaced the early strong ridge.

Low temperatures were most extensive at the beginning of the month when the westerlies across the United States were depressed (fig. 6). During most of the remainder of the month (figs. 7, 8, 10), a cold in the West, warm in the East pattern accompanied a deeper than normal western trough and a stronger than normal eastern

ridge. Retrogression of the western trough to the east Pacific during the December 21–25 period was accompanied by above-normal temperatures over most of the Nation (fig. 9). New record daily maximum temperatures for the month were observed during the December 10–16 period at several locations in states bordering the Gulf and Atlantic Coasts from Louisiana to Connecticut and also in Ohio and West Virginia.

During much of the month (figs. 6, 7, 9), substantial areas of precipitation were observed in the Pacific Northwest in response to stronger than normal westerly wind components. Heaviest amounts occurred when the trough off the West Coast was deepest (figs. 6, 9).

Relatively heavy precipitation from the west Gulf Coast to the Great Lakes occurred during those periods when the western trough and eastern ridge were both amplified, producing a sequence of deepening storms moving from the Southwest to the Great Lakes (figs. 7, 8, 10).

Heaviest precipitation in the Southeast occurred early in the month in connection with the depressed westerlies and the accompanying depressed storm track (fig. 6). Further substantial precipitation in that area occurred when the mean ridge retrograded to mid-Nation (fig. 9) and a short-wave trough traversed the Southeast.

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Dickson, Robert R., "Weather and Circulation of October 1971—Continued Cold in the West and Warm in the East," *Monthly Weather Review*, Vol. 100, No. 1, Jan. **1972**, pp. 74–79.

Environmental Data Service, NOAA, U.S. Department of Commerce, and Statistical Reporting Service, U.S. Department of Agriculture, *Weekly Weather and Crop Bulletin*, Vol. 58, Nos. 49–52, Dec. 6, 13, 20, and 27, **1971**, and Vol. 59, Nos. 1 and 2, Jan. 3 and 10, **1972**.

Taubensee, Robert E., "Weather and Circulation of November 1971—Cool in the Northeast in Association with the Development of an East Coast Trough," *Monthly Weather Review*, Vol. 100, No. 2, Feb. **1972**, pp. 171–176.

CORRECTION NOTICE

Vol. 99, No. 12, Dec. 1971, p. 901, right col: eq (50) and (51) should read

$$Q_{ws}=3.8p^{-1}10^{\frac{7.5(T-273)}{T-36}} \tag{50}$$

$$Q_{is}=3.8p^{-1}10^{\frac{9.5(T-273)}{T-8}} \tag{51}$$

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